9
Suggested Mechanisms of Population Regulation

BISON POPULATION NUMBERS have been regulated by both natural and artificial means since the park was established. Regulation of the original bison population must have resulted entirely from environmental and populational mechanisms. Regulation, to a varying degree, has been imposed by man since near-extermination of the original bison. Limited knowledge of original bison population characteristics, habits, and distribution, together with application of ranching methods to the plains bison introduced in 1902, has influenced subsequent management practices. After 1952, all vestiges of artificial management, except reductions to control population numbers, were eliminated. Reductions were continued at irregular intervals to compensate for the alterations in natural conditions which were the accepted result of the establishment and use of the park, and settlement of the surrounding country.

Information from the present study indicates that compensatory reductions are not necessary on all population segments; the need for future reductions on any population segment is less clear. Figure 51, which shows the known Pelican Valley wintering bison population from 1902 through 1968, suggests that at least this part of the bison population has been regulated for many years without interference by man. Since the time of intensive poaching in the 1890s, reductions have been made there only twice: 118 bison in 1956, 34 bison in 1965. Following the near-extermination before 1902, the population increased gradually for nearly 20 years. Counts as shown are probably somewhat low, but suggest that a fairly stable population existed for another decade. A general slow upward trend is evident from the early 1930s to the early 1950s, but the population remained near or below 300 animals until after 1952. Between then and 1954, when 461 bison were counted, there was a marked increase. Subsequent low numbers by 1957 and thereafter seem inadequately explained by either reductions or group shifts.

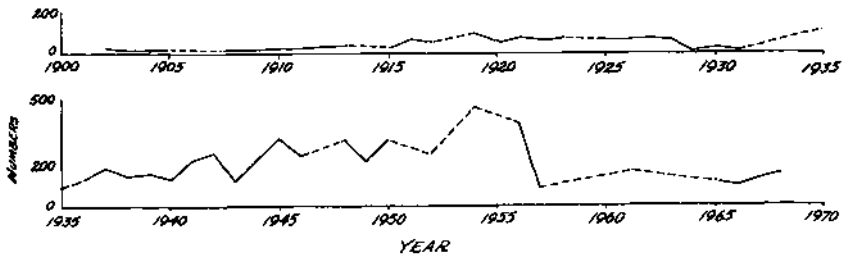

Fig. 51. Pelican Valley population numbers, 1902-68.

A complex of environmental influences probably is involved in what appears to be a naturally regulated population. Emigration from the Pelican area has not been an important factor (see Population Trends) in spite of the occasional temporary group shifts. Predation and disease, previously discussed, have been only minor influences. Environmentally influenced factors of low reproduction rates compared with those of other bison herds, low increment rates in spite of some increase in new-calf percentages following recent reductions, and heavy mortality during exceptionally severe winters appeared most important in Yellowstone as a whole. Presumably, the same factors apply to Pelican as a subunit.

Environmental effects, particularly the combination of low temperature conditions and snow depths sufficient to require considerable efforts for survival, were not measured and were difficult to observe, but were suggested by the differential mortality among sex and age classes indicated by trap records. Survival rates of calves during the first year, compared with the decreased rates among yearlings and 2-year-olds, suggested that calves, perhaps because of closer association with the cows, were not as stressed by environmental conditions. Yearlings and 2-year-olds—less closely associated with a particular adult, and of smaller size (particularly females) and less social standing compared with 3-year-olds—might be at a disadvantage, less able to forage effectively and less able to travel in deep snow. McHugh (1958) observed a dominance hierarchy based on sex and age. He noted that calves derived dominance from their cows, and that dominance was displayed in feeding situations and deep-snow travel. The stress on subordinate animals, as well as aged or otherwise weakened adults, would increase with increasingly severe weather regardless of forage availability for

TABLE 18. *Presence of factors which may affect suitability of habitat for wintering mixed herd groups.*

Valley	Bison herd groups	Sedge bottoms	Sage-Grass side hills	Warm bottomland	More than 3 thermal sites	Extensive thermal	Warm open streams	Less severe climate
Antelope Creek[a]	small	+	+					
Bechler	small	+					+	
Blacktail			+					+
Cougar Creek area[a]	small	+	+					
Elk Park		+						
Firehole	+	+		+	+	+	+	
Gallatin River		+	+					
Gardiner area			+					+
Gibbon Meadows		+						
Hayden Valley	+	+	+	+	+		+	
Lamar	+	+	+					+
Norris area					+	+	+	
Pelican Valley	+	+	+		+		+	
Swan Lake area		+	+					

[a]No bison present since mid-1950s.

the entire population. The relationship between numbers of animals, available forage, and mortality did not appear to be direct; forage quantity, although affected by snow depth and distribution, exerted effects in combination with the physical stress imposed by snow depth and storm conditions at low temperatures.

Figure 51 also shows a level below which the Pelican population has not dropped since the recovery (about 1935) from the low of 1902. Although only 88 were counted in 1957, no attempt was made to locate all animals (Jim Stradley 1968 pers. comm.). Thus, approximately 100 animals may represent the maximum population which could survive the most severe winter, but perhaps a figure of 100-200 bison better represents a level around which this population has fluctuated since 1935. That bison have survived, and at this population level, in a valley such as Pelican in spite of severe winters suggests that a margin for survival might be represented in parts of the Yellowstone environment which does not occur elsewhere.

The survival factor for bison in parts of Yellowstone may be the existence of thermal areas. As previously discussed, thermally active areas do not attract large numbers of bison for the winter, but the use of certain areas for brief periods—particularly at times of prolonged cold combined with deep snow as observed by Jim Stradley, or in late winter as seen during the study period—may determine the lower limits to which the population numbers drop.

A comparison of the larger Yellowstone valleys (Table 18) gives further evidence on which factors make habitation by bison possible. In addition to the previously discussed wintering valleys, there are other large valleys in Yellowstone where bison herd groups apparently were never known, historically or more recently. Extensive sedge bottoms are a feature of the valleys used by bison; additionally, where winter conditions are consistently less severe, as in Lamar, there are extensive open side hills of sagebrush-grassland which allow both movement and feeding. Where winters are more severe, those valleys which have bison have either extensive thermal or warm areas, or else many small ones among which movement is possible. Some streams which remain unfrozen because of an influx of warm water are an additional feature of most wintering areas, as are some river benches or valley side slopes and small hills (sagebrush-bunchgrass upland sites) which aid both foraging and movement. Where too few of these factors occur together the valleys do not now, and probably never did, support mixed herd groups of bison.